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ROYAL BOTANIC GARDENS, KEW

XL—Dr. LEONARD COCKAYNE, F.R.S.

The Science of Botany has suffered an irreparable loss in the death of Dr. Leonard Cockayne, C.M.G., F.R.S., on July 8th, 1934, and the Dominion of New Zealand has lost one of her most distinguished citizens who had attained a world-wide reputation in the domain of Botany.

Born in Derbyshire, in 1855, the son of the late Mr. William Cockayne of Norton Lees, he was educated privately and entered Owens College, now Manchester University. In the year 1879 he left England for Australia, where he was engaged in teaching for a short time. He moved to New Zealand in 1881, and there he made his home—never returning to England. From 1881 to 1885 he was a member of the teaching staff of the Tokomairiro District High School and subsequently commenced farming near Christchurch. During this time, between 1882 and 1884, he started a private experimental station and introduced many thousands of shrubs, herbs and orchard trees. It was then that he began to study the seedlings of New Zealand shrubs, which show such remarkable juvenile forms in the seedling stage, as to both their habit of growth and leaf-form, quite distinct from the adult condition. This led him to investigate the flora of New Zealand from many points of view and it is to him we owe our knowledge of the remarkable prevalence of interspecific hybrids which occur in so many genera of New Zealand plants.

Cockayne's knowledge of the New Zealand flora was not that of the herbarium botanist, but was derived from extensive field study. He had travelled far and wide throughout the Dominion and, in addition, had explored very thoroughly the Chathams and Subantarctic Islands. From 1906 onwards he carried out important botanical surveys for the Land and Survey Department and he prepared reports on the reclamation of sand dunes, Kapiti Island, the Waipoua Kauri Forest, Tongariro National Park and on Stewart Island.

It was, we believe, while studying the New Zealand beeches (*Nothofagus*) that Cockayne's attention was first drawn to the prevalence of hybrids and "hybrid swarms," as he termed them, in the New Zealand flora, and in this work he was further stimulated by the late Dr. Lotsy when he visited New Zealand. These studies he continued with vigour, building up a school of enthusiastic amateur and professional botanists who, it is to be hoped, will carry on the work as a tribute to their Master's memory.

New Zealand with its rich endemic flora is, of course, an ideal region for the naturalist and, thanks to the activities of botanists from the time of Banks and Solander (1769–70) onwards, the flora has been relatively well investigated. Cockayne's great contribution has been his pioneer work in the ecological study of the vegetation and the problems of plant evolution as presented by the flora. The value of this work is due to his extensive botanical travels in the Dominion and to his keen and critical eye ; one need only examine the titles of his many contributions to realise both the wide and original nature of his research and something of the stimulus he gave to the study of the plant life in the Southern Hemisphere—of this stimulus I can speak from first-hand knowledge.

During my visit to New Zealand I was most fortunate in having Dr. Cockayne as my guide, and it was largely owing to his influence that I was able to see so much of the island. He took me across to Nelson and to the Western Mountains and the Franz Joseph Glacier and, during our journey through Arthur's Pass in particular, it would have been impossible to have had a more delightful or more instructive companion to introduce one to the remarkable number of hybrid swarms to be seen in that area. In the North Island we visited Auckland and Rangitoto Island and thence, by way of Tongariro National Park to Mount Egmont and back to Wellington via Palmerston North. Throughout our journeys his great knowledge of the New Zealand flora, and his keen interest in the native plants and the problems they present, was a revelation to a visiting botanist. The success of the plans he had outlined for my tour was due in great measure to the excellent organising powers of his son Alfred, and also to the trouble so kindly taken by Dr. Marsden and Mr. Callaghan of the Department of Scientific and Industrial Research.

Throughout our long and sometimes tiring journeys, Dr. Cockayne was astonishingly active, though he was then an old man, and the hurried tours might well have upset him. The following extract from my diary, which I wrote on board ship (Feb. 14, 1928) just before we set sail from New Zealand, recalls him vividly to my memory : " He was at times a trifle disturbed by a sudden change of plan and had a facility for losing his cap or his bag, but his sense of humour always saved the situation and we had a great time together. No matter whether we were in a crowded train or wedged in the back seat of a motor car, he would discuss abstruse botanical matters or bring forward knotty points as to hybrids, or what was meant by such and such a species. Then his son Alfred would join in with a totally opposite point of view and a fierce altercation, proving quite harmless, would ensue—an outsider might have thought blows would follow !—and all would end happily."

He was sometimes a little intolerant with regard to the work of other botanists who might not agree fully with his own views and was at times inclined to belittle their contributions to the science. He certainly did not always " suffer fools gladly " but when he came to

appreciate the worth of a fellow botanist's work, either in New Zealand or elsewhere, he would be only too ready to share his views with him.

Cockayne's special interests were undoubtedly centred in the study of plants as living organisms and hence in the major problems of biology. Apart from vegetational studies, he delighted in considering plant morphology from a dynamic standpoint. His early investigation into the form of seedlings, his research on the variation of leaves, the significance of spines, and latterly his field-studies on hybridism (with Dr. H. H. Allan), indicate not only the intensive and extensive nature of his research, but also his desire to answer the how and wherefore of every problem connected with the botany of his adopted country.

Cockayne's first synecological publications dealt with the burning and regeneration of subalpine scrub, which had been preceded by his accounts of the freezing of New Zealand alpine plants and of the seedling forms of New Zealand Phanerogams. These were followed in 1912 by his important paper "Observations concerning evolution derived from ecological studies in New Zealand" and by several others in which he laid stress on the evolutionary aspect; but the culmination of his studies, based on his wide knowledge gained from his travels, was revealed in "The Vegetation of New Zealand" which was published as vol. 14 of Engler and Pruden's "Die Vegetation der Erde" in 1921. This met with so much appreciation that the first edition was sold out in a year and a second edition was published in 1928.

His admirable book "New Zealand Plants and their Story" has perhaps done more to further the study of Botany in New Zealand, and also to stimulate interest in plant life far beyond the Dominion, than any other of his writings. In this book (the first edition of which was published in 1910, followed by the second edition in 1919 and a third in 1927), the underlying idea is that of "the plants telling their own story," but the interpretation of this story is obviously that of a master-mind. A remarkable feature of the book is the simplicity of its language with its avoidance of the tiresome words and phrases so often associated with over-popularization.

It is for New Zealanders themselves to estimate and acknowledge what they owe to Cockayne as a teacher, in that broad sense of the term as one who by inspiration and example leads the way. It is obvious to others that the influence of such a text book, of wide appeal, well produced and illustrated and yet of low price, must continue through many generations. The application of ecology to economic problems was another feature of much of Cockayne's research. Forests, sand-dunes, and pastures, especially the last, were investigated with a view to their preservation, stabilization, and improvement. That his own words*—"it seems clear that New Zealand is attempting to do its economic ecological duty"—are true, is mainly due to Cockayne himself. His wide botanical know-

* Report, Imperial Botanical Congress, 266 (1925).

ledge made his advice of inestimable value on the Royal Commission on Forestry (1913), the Cawthron Commission (1919), the Royal Pastoral Commission (1920), as well as in his position of Hon. Botanist to the New Zealand State Forest Services.

The outstanding memorial to Cockayne's genius and foresight is the establishment of the open-air "Plant Museum" at Otari (Wilton's Bush), near Wellington (see K.B. 1926, 428, and K.B. 1929, 63, 64). It seems fitting here to quote what I wrote after the inauguration ceremony: "On January 25th, 1928, I was present at the formal inauguration of this fine area by the Mayor of Wellington, and had the opportunity of visiting the whole of the reserved area, which is very richly furnished with an almost untouched collection of native plants. As many characteristic New Zealand trees, shrubs and herbaceous plants are not to be found in the old bush, Dr. Cockayne, to whose keenness and enterprise the initiation of this important scheme is due, has arranged for the planting of as representative a collection of New Zealand plants in this remarkable open air Museum as may be likely to flourish there."

As His Excellency the Governor-General said recently at a public recognition of Cockayne's work—"Dr. Cockayne had done an unexampled work in enriching the annals of natural science and in enriching and beautifying the lives and environment of his fellow-countrymen. But he had done more; he had been a very generous benefactor who would leave behind him a legacy of economy as well as a legacy of aesthetic value."

Cockayne retained his keen interest in his botanical studies to the close of his life, and though during the last few years he was sadly hampered by impending blindness, yet he worked always with the energy and enthusiasm of a young man.

There was a strain of poetry in his nature which can be appreciated in his "New Zealand Plants and their Story" and other of his writings, and it was the poetry in him which lent wings to his imagination and gave depths to his insight. This poetical feeling is expressed in the popular names he gave to many New Zealand plants, and he attached such names, and also the Maori names, to the native plants in the Otari Museum, realising that by such names they will be remembered. It was also a happy idea of his to name the entrances, paths and other features in the "Museum" after botanists connected with New Zealand.

The following passage extracted from "The Evening Post" of Wellington, of July 9th, 1934, very fittingly sums up his vigorous personality:—

"In field work Dr. Cockayne stood alone. A fortnight spent at Arthur's Pass in his company, collecting plants for the museum, was an experience never to be forgotten. While his writings and his work in connexion with the Otari Plant Museum place him as a man above his fellows, to my mind the inspiration he was to the young botanists of the Dominion was his outstanding characteristic. His vast knowledge was at the disposal of all; and, as indicated, his inspiration to others in regard to botanical research has played a very great part in the interest displayed

by large numbers of enthusiasts who are following in his footsteps. For many years he was as a voice crying in the wilderness, when stressing the damage done by the introduction of certain animals into our forests. His lead has, however, now been taken up by the Government, which is taking action to prevent further damage being done. A great botanist, he was also a great gardener, and I desire to pay a tribute to one who has done more than any other for New Zealand's incomparable flora, and who has brought fame in the botanical world to his adopted country."

Many honours were conferred upon him, including the Hon.Ph.D. of Munich (1903); the Fellowship of the Royal Society of London (1912), followed in 1928 by the award of the Darwin Medal; the Hector Medal and Prize for Botany in 1912, and the Hutton Memorial Medal in 1914. In 1918-1919 he was President of the New Zealand Institute (now the Royal Society of New Zealand), and in 1928 he was awarded the Mueller Medal by the Australasian Association of Science for his researches on New Zealand Botany. In 1932 the Royal Horticultural Society of London awarded him the Veitch Memorial Medal. In 1929 the honour of the Companionship of the Most Distinguished Order of St. Michael and St. George was conferred upon him by His Majesty the King.

Cockayne was buried very fittingly in the Otari Museum, which is his true and lasting Memorial, near the Banks' Entrance, on a spot overlooking the primitive vegetation of the bush and facing the Cockayne Heights. May his spirit continue to stimulate his countrymen to love and cherish their native vegetation and to carry on the traditions which he has established.

A. W. H.

XLI—MUSCI COLLECTED BY THE OXFORD EXPEDITION TO BRITISH GUIANA IN 1929.

P. W. RICHARDS.

The following paper is a complete enumeration of the mosses collected by the author in August to December 1929, while a member of the Oxford Expedition to British Guiana. The majority came from the neighbourhood of the Expedition's Base Camp on Moraballi Creek, River Essequibo (Lat. $6^{\circ} 11' N$, Long. $58^{\circ} 50' W$), the remainder from various places, all of them within a radius of 40 km. from the Base Camp. All the gatherings were made in tropical rain-forest at altitudes only a few feet above sea-level: a detailed account of the vegetation, soil and climate of the area has been published by T. A. W. Davis and the author (1).*

At the same time the opportunity has been taken of working out a small collection from the Cuyuni and Potaro Rivers made by T. G. Tutin on Dr. G. S. Carter's Cambridge Expedition in 1933 and a number of unnamed mosses sent for study by the Jenman Herbarium, Georgetown, British Guiana, including specimens from various parts of the colony, collected chiefly by A. W. Bartlett in 1904-7 and A. A. Abraham in 1919 (on the Cattle Trail Survey).

Up to the present the moss-flora of British Guiana has been very little known. There are a few species in the Kew and British

* For references see p. 337.

Museum Herbaria collected by Robert Schomburgk, Drake, C. S. Parker and C. F. Appun : most of these are mentioned by Mitten in his " Musci Austro-Americani " (2). In 1884 Sir E. F. im Thurn collected three species on Roraima which were identified by Mitten (3). In 1895 J. J. Quelch made a small collection of mosses near the Marshall Falls, River Mazaruni, of which there is a duplicate set at Kew : they were determined by C. Müller-Hal., who described no less than 20 of them as new (4), but most of these new species seem to be ill-founded. A few mosses were collected by Goebel while on a visit to the North-Western District in 1890-91 and these were also determined by Müller (5). The collections made by F. V. McConnell and J. J. Quelch on the Roraima Expeditions of 1894 and 1898 included 26 species of mosses, which were identified by Brotherus (6). Finally, E. H. Graham has recently published a list of some mosses collected by himself and A. E. Emerson in the neighbourhood of Kartabo Point (7).

It is of course too early to say much as to the phytogeographical affinities of the British Guiana moss-flora, but it is already clear that it is on the whole closely related to that of the Amazon and especially to that of its tributary the Rio Negro.

In the following list the specimens were collected by the author unless otherwise stated. The types of forest (" Mora ", " Wallaba " etc.) referred to in the habitat data are described in the paper on the vegetation of Moraballi Creek mentioned above.

The first set of the Oxford Expedition collection and a duplicate set of the collection sent from the Jenman Herbarium will be kept at Kew. T. G. Tutin's collection will go to the British Museum Herbarium. All previous records of each species from the Colony are given, but the determinations have not been revised by the author : these records refer to specimens in the Kew Herbarium unless otherwise stated.

In conclusion my best thanks are due to Mr. R. S. Williams of the New York Botanical Garden for much generously given help. Not only has he taken over the determination of the *Fissidentaceae*, but he has also checked my identifications of a large proportion of the remaining species. Except where species are definitely stated to be determined by him, the identifications must however rest on my own responsibility alone. I should also like to thank Mr. W. R. Sherrin for naming the Sphagna.

It is hoped to give some notes on the ecology of the bryophytes at Moraballi Creek in a later paper.

SPHAGNALES.

SPHAGNACEAE (*Det.* W. R. Sherrin).

Sphagnum trinitense C.M.—*S. cuspidatum* Ehrh. var. *serrulatum* Schlieph.

Berbice : Eberoabo Creek, submerged in Ite swamp, *Abraham* 140.

Distr : Tropical America and northwards to Maine and Bermuda.

S. portoricense *Hampe.*

Pomeroon River, *Bartlett* 8677.

Distr. West Indies to New Jersey.

S. antillarum *Schp.*

Potaro River : rock at top of Kaieteur Fall, *Tutin* 652.

Distr. Surinam, Trinidad.

BRYALES

FISSIDENTACEAE (*Det.* R. S. Williams)

Fissidens Garberi *Lesq. et James.*

Moraballi Creek : bases of shrubs in swampy Mora forest, *c.fr.*, 599 ; granite boulders in Morabukea forest, *c.fr.*, 719.

Distr. Haiti, Bermuda, South-eastern United States.

F. pellucidus *Hornsch.*

Moraballi Creek : trunk of large tree in well-lit Morabukea forest, *c.fr.*, 445 ; base of tree in mixed forest, *c.fr.*, 454.

Distr. Brazil.

F. prionodes *Mont.*

Moraballi Creek : common on recently disturbed clayey and sandy soil in forest, *c.fr.*, 45, 216, 258, 323, 518, 744.

Distr. French Guiana, Brazil, Ecuador, Peru.

F. Puiggarii (*Geh. et Hampe*) *Paris.*

Cuyuni River : near Akaio Landing, in " Low Bush " on clay soil thrown up by fallen tree, *c.fr.*, 831.

Distr. Brazil.

Moenkemeyera Richardsii *R. S. Williams*, sp. nov. Dioica et autoica, floribus masculis terminalibus : plantulae nanae, caulis simplex vel ramosus ; folia superiora et perichaetialia parte equitante laminae limbata, parte superiore et dorso serrulata, cellulis totis brevibus usque ad basin folii densissime papillois ; seta 1.5–2 mm. longa ; theca suberecta, plus minusve cylindrica, circiter 1 mm. longa, operculum breve, oblique rostratum ; peristomii dentes lanceolati, simplices, rubri, papillois ; sporae 16 μ ; calyptra papillosa.

Dioicous and *autoicous*, the *male* flowers terminal, consisting of about 6 antheridia and few or no paraphyses, with the two inner leaves longer and narrower than the stem-leaves and more or less lobed in the lower part : plants small, up to 5–6 mm. high, simple or branched, the *leaves* more or less curved-reflexed when dry, those of upper stem about 0.75 mm. long and 0.25 mm. broad, acutely or somewhat bluntly pointed, serrulate to the base, the duplicate lamina extending to above the middle and mostly terminating nearer the costa than margin, the one or two pairs of leaves just below the perichaetium mostly with distinct, hyaline borders on the duplicate lamina, the leaves farther down becoming gradually smaller and without border ; *costa* ending just below the apex ; *leaf-*

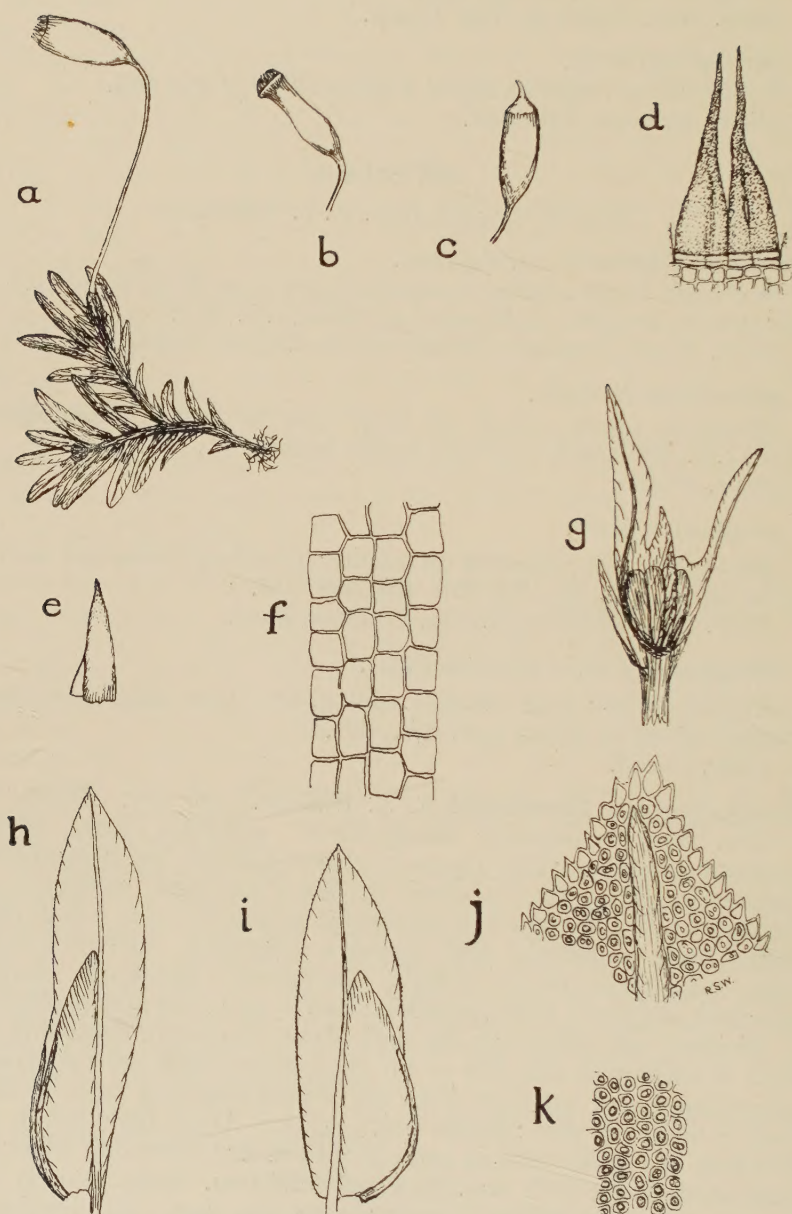


Fig. 1. *Moenkemeyera Richardsii* R. S. Williams. a, plant ($\times 14$); b, dry empty capsule ($\times 14$); c, capsule with lid ($\times 14$); d, part of peristome ($\times 180$); e, calyptra ($\times 40$); f, median exothecial cells ($\times 180$); g, part of antheridial bud ($\times 32$); h, upper perichaetial leaf ($\times 40$); i, upper stem leaf ($\times 40$); j, apex of stem leaf ($\times 270$); k, median cells of leaf ($\times 270$).

cells obscure, mostly rounded or somewhat irregular, scarcely elongate, and covered on both sides with large often branching papillae extending to leaf-base; *perichaetial leaves* about like those of upper stem, but rather longer, about 1 mm., and a little narrower: *seta* 1.5–2 mm. long; *capsule* about 1 mm. long, with slightly obliquely beaked lid, more or less contracted under the mouth when empty and sometimes becoming narrowly cylindrical; the median exothecial cells large, short-rectangular, with thin walls; *peristome teeth* dark red, lanceolate with slender points, undivided and densely papillose to near base; *spores* finely punctate, up to 16 μ in diameter; *calyptra* extending to a little below the rim of capsule, more or less papillose, at least near apex.

Moraballi Creek: in swampy Mora forest, on trunk of *Miconia Plukenetii* Naud., *c.fr.*, 118 (type); in damp forest, on bark of *M. Plukenetii*, *c.fr.*, 41. Not uncommon in the district and showing a marked preference for growing on species of *Miconia* (*Melastomaceae*).

Distr. Windward Islands: Granada, Grand Etang, alt. c. 1800 ft., 1929, *Richards* 935.

DICRANACEAE.

Dicranella exigua (*Schwaegr.*) Mitt.

Essequibo River: Bartica, sandy bank of ditch in cultivated ground, *c.fr.*, 855. *Det.* R. S. Williams.

Distr. Tropical South America, West Indies.

Campylopus gracilicaulis Mitt.

Berbice: "savannah lands, on white sand of *muri*", *Abraham* 145 (in part); Wiruni-Ituni Savannahs, on white sands, *Abraham* 144 (in part) and 136 (in part). These gatherings agree very closely with those of Spruce from the Rio Negro (*Musc. Amaz. et And.* 60).

Distr. Tropical South America, West Indies, Florida.

C. introflexus Brid.

Essequibo River: Bartica, on sandy soil, burnt scrubby land, 854.

Distr. Widely spread in the warmer parts of the world.

C. Sprucei Mitt.

Potaro River: forest on Kaieteur Plateau, *Bartlett* sine num.

Distr. British Guiana, *Appun* 583, *N. D. F. Pearce*.

Rio Negro (Brazil).

C. trachyblepharon (C.M.) Mitt.

Essequibo Coast: back of Onderneeming, *Bartlett* 8604. Berbice: mixed with *C. gracilicaulis*, same localities and habitats, *Abraham*, part of 144, 145 and 136.

Distr. Eastern Brazil.

Holomitrium arboreum Mitt.

Moraballi Creek : on Mora tree, 130 ft. from ground, *c.fr.* 275 ; on trunk of tree overhanging creek, *c.fr.*, 519 (in part).

Distr. Andes from Bolivia to Mexico.

LEUCOBRYACEAE.

Leucobryum crispum C.M.

Moraballi Creek : extensive loose tufts on slightly shaded sandy bank in forest, 195.

Distr. Roraima Range, 3500 ft., *McConnell and Quelch* 546.

Tropical South America, West Indies.

The specimens in Kew Herb. determined as this species by Mitten obviously belong to two distinct species, one of which agrees with Müller's description and the other of which is much larger (probably *L. megalophyllum* (Raddi) Mitt.).

L. Martianum (Hornsch.) Hampe.

Moraballi Creek : common on rotten wood, less frequently on living trees, *c.fr.*, 102. Essequibo River : near Bartica Grove, *c.fr.*, *Jenman* 2333. Pomeroon River, *c.fr.*, *Bartlett* 7953 and 8678. Berbice : Yawakuri River, on decaying tree trunks, *c.fr.*, *Abraham* 222. Bartica-Potaro Road, 82 miles, on fallen tree in *Dicymbe* forest, *c.fr.*, *Tutin* 284.

Distr. British Guiana, *Appun* 724 and 727. North-Western District : Amakura River, *De La Cruz* 3434.

Tropical South America, West Indies.

L. antillarum Schp.

Potaro River : forest on Kaieteur Plateau, *c.fr.*, *Bartlett* sine num. Det. R. S. Williams.

Distr. Tropical South and Central America, West Indies.

Octoblepharum albidum Hedw.

Moraballi Creek : abundant everywhere, 93. Rarely fertile except on the upper branches of tall trees. Essequibo River : Bartica, *c.fr.*, 853. Cuyuni River, *c.fr.*, *Bartlett* 8604. Georgetown Botanic Garden, *c.fr.*, *Bartlett* sine num. Pomeroon River, *Bartlett* 8676. Berbice : Yawakuri River, on stem of Turu palm, *Abraham* 168. Bartica-Potaro Road, 82 miles, in *Dicymbe* forest, *Tutin* 266.

Distr. British Guiana, *Schomburgk* sine num., *Appun* 723 and 814. Mazaruni River : near Marshall Falls, *Quelch* (ex herb. *Levier* 1282). Cuyuni River : Kartabo and Camaria Road, *Graham*, *Bryologist*, **36**, 65 (1933).

Pantropical.

CALYMPERACEAE.

Syrrhopodon anomalus Broth.

Moraballi Creek : trunk of small tree overhanging creek, 171 (in part). Det. R. S. Williams.

Distr. Brazil, Paraguay.

S. Leprieurii Mont.

Moraballi Creek: on trunk of tree in light place, moist forest, *c.fr.*, 144; trunk of tree overhanging creek, *c.fr.*, 519 (in part).

Distr. French Guiana, Rio Negro (Brazil), Bolivia.

S. rigidus Hook. et Grev.

Moraballi Creek: tree trunk by creek, *c.fr.*, 186. Some of the leaves bear clavate gemmae at the apex.

Distr. Tropical South America, West Indies.

S. Miquelianus C.M.

Moraballi Creek: trunk of small tree on edge of creek, *c.fr.*, 90; trunk of small tree overhanging creek, 171 (in part), gemmiferous, 172.

Distr. Surinam, Rio Negro (Brazil), Bolivia, Nicaragua.

S. Hobsoni (Grev.) Hook. et Grev. var. **luridus** (Paris et Broth.) P. W. Richards.—*S. luridus* Paris et Broth. Rev. Bry. 33, 56 (1906).

Moraballi Creek: frequent on tree trunks in well-illuminated forest, 103, 220, 449.

Distr. French Guiana. The typical form has been recorded from "Guiana", Brazil, Trinidad and Cuba.

The Moraballi plant is very constant in its characters and always sterile. It agrees perfectly with a few stems of the original gathering of *S. luridus* (French Guiana, Michel) which I have been able to examine by the kindness of Mr. R. S. Williams, except that the cells in the upper part of the leaf are slightly larger and more elongated. As Mr. Williams suggests, however, *S. luridus* does not seem to be specifically distinct from *S. Hobsoni* and is separated from it by no well-defined structural characters. Brotherus had probably also come to this opinion, as he did not include *S. luridus* in the "Pflanzenfamilien", ed. 2. *S. luridus* does however differ from all forms of *S. Hobsoni* which I have examined in the leaves being straighter and more rigid when dry and with the sheathing base more widely expanded upwards, also in the dull yellowish colour (in both the wet and the dry state) and as these characters seem to be quite constant it is probably worth maintaining as a variety.

Calymperes rupicola P.W. Richards, sp. nov. (Sub-gen. *Hyophilina* Sect. *Climacina*).—Ut videtur *C. Glaziovii* Hampe proxima, sed multo major, foliis acutis, cancellinis multo longioribus in gradationem longam attenuatis valde differt.

Robusta, *caespites* laxi, molles, laete flavo-virentes, siccitate sordidi. *Caulis* ad 3 cm. longus, nonnunquam superne divisus. *Folia* saepissime proboscidea, siccitate flexuosa divergentia, madore erecto-patentia, 3–4 mm. longa, e basi late cuneata lingulata, ad apicem acutam attenuata, basi 0.4–0.7 mm., parte expansa superne 0.8–0.9 mm., parte lingulata 0.7 mm. lata, *marginē* incrassato fere plano, apicem versus et parte expansa superne serrulata vel subserrulata, ceterum integra; *costa* valida ad basin 90–100 μ lata, per

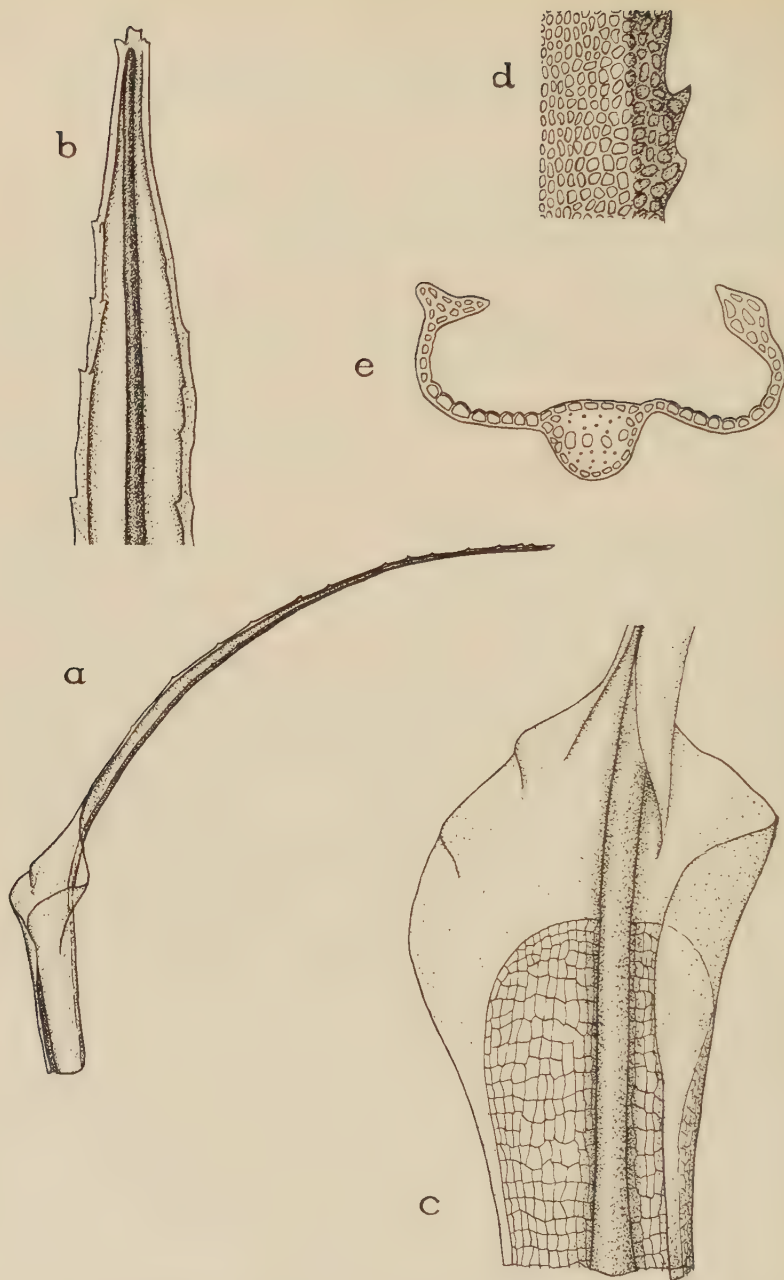


Fig. 2. *Syrrhopodon Hobsoni* (Grev.) Hook. et Grev. var. *luridus* (Paris et Broth.) P. W. Richards. a, leaf ($\times 15$); b, apex of leaf, dorsal view ($\times 60$); c, base of leaf ($\times 60$); d, cells in upper part of leaf ($\times 250$), e, section through upper part of leaf ($\times 250$). a-d drawn from type of *S. luridus* (French Guiana, Michel), e from Richards 220.

totam longitudinem fere aequa, paulo ante apicem evanida, superne scabrida; *cancellinis* partem expansam fere totam occupantibus, 12–15-seriatis, in gradationem costam versus desinentibus, *cellulis chlorophyllosis* obscuris hexagonis, 4–6 μ latis, supra papillosis, *teniola* cancellinis multo brevior, basin versus 3 cellulis lata superne latiore, *cellulis marginalibus* partis expansae basin versus longe

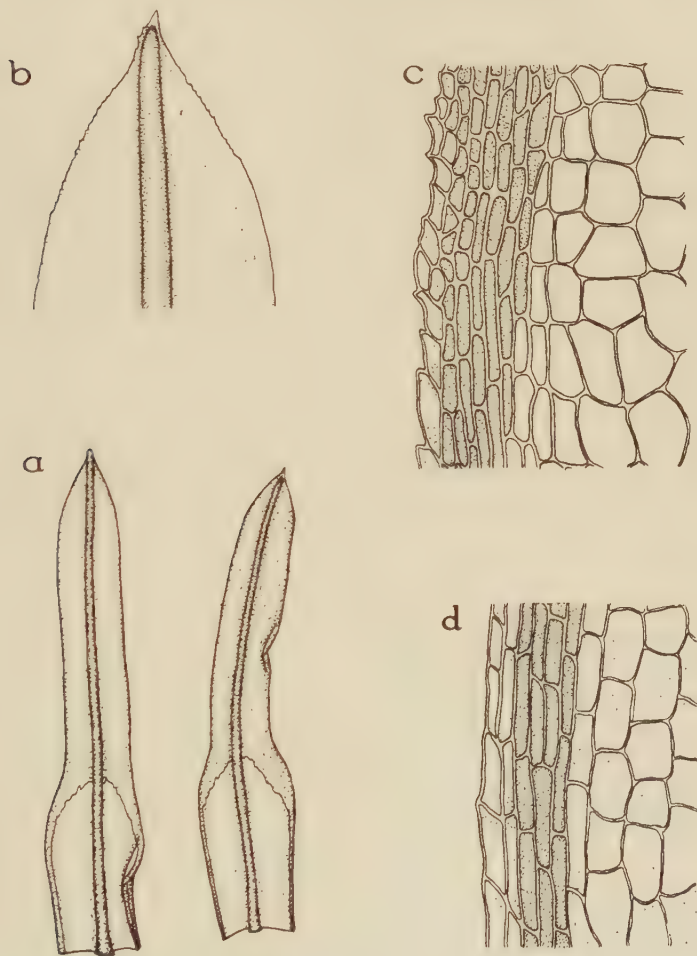


Fig. 3. *Calymperes rupicola* P. W. Richards. a, leaves ($\times 15$); b, apex of leaf ($\times 60$); c, marginal cells of upper part of base of leaf ($\times 250$); d, marginal cells of lower part of base of leaf ($\times 250$).

rhomboidalibus, superne brevioribus more denticulorum prominentibus: *folia proboscidea* costa longe excurrente gemmis clavatis 4–6-cellulatis praedita. Cetera ignota.

Essequibo River: first falls, on dry gneiss rocks near the river, 357.

A specimen communicated to me under the name of *C. Heribaudii* Paris et Broth. (Prov. Chirique, Panama, 1906, collector's name illegible [Heribaud?]: ex herb. New York Bot. Garden) is very close to and may be conspecific with this plant: it differs however in having less acuminate leaves, with the lamina about half the width and the sheathing base less serrulate. *C. Heribaudii*, though mentioned by Brotherus in the "Pflanzenfamilien", ed. 2, 10, 239, seems to be a *nomen nudum*.

C. Sprucei Besch.

Moraballi Creek: on trunk of tree, 4 ft. from the ground, opening in forest, 394 (in part).

Agrees well with the portion of the type specimen in Bescherelle's herbarium (Brit. Mus.).

Distr. Rio Negro (Brazil) (part of *Musc. Amaz. et And.* 20).

C. disciforme C.M.—*C. Wulfschlaegelii* Lor.

Pomeroon River, *c.fr.*, Bartlett 8674. Mazaruni River, Bartlett sine num. Georgetown: Botanic Garden, *Cleare*.

Distr. Surinam, French Guiana, Martinique, Florida.

C. lonchophyllum Schwaegr.

Moraballi Creek: on tree trunks in rain-forest, *c.fr.*, 91, 145, 437. Pomeroon River, *c.fr.*, Bartlett 8050; Aruka River, Bartlett 8608.

Distr. Mazaruni River: near Marshall Falls, *Quelch*. Cuyuni River: vicinity of Kartabo, *Graham*, *Bryologist*, 36, 65 (1933).

Eastern Brazil to West Indies.

DREPANOPHYLLACEAE.

Drepanophyllum fulvum Rich.

Moraballi Creek: on trunk of *Miconia Plukenetii* Naud. and neighbouring rotten trunk, 263; trunk of small tree in Greenheart forest, 743.

Distr. Demerara, *Parker* in Brit. Mus. Herb., also "ex herb. *Arnott*", Mitten, *Musc. Austr. Am.*, 318.

Amazon to West Indies.

ORTHOTRICHACEAE.

Macromitrium mucronifolium (Hook. et Grev.) Schwaegr.

Moraballi Creek: branches of tree, about 130 ft. from ground, Mora forest, *c.fr.*, 647; on tree, 90 ft. from ground, Morabukea forest, *c.fr.*, 810. Essequibo River: dry gneiss rocks at first falls, 356. Bartica-Potaro Road, 82 miles, on branch of tree in *Dicymbe* forest, *Tutin* 269 (in part).

Distr. Roraima Range, 3500 ft., *McConnell* and *Quelch* 544. Cuyuni River: Matope Falls, on rocks, *Graham*, *Bryologist*, 36, 66 (1933).

Tropical South and Central America, West Indies, Florida.

M. laevifolium Mitt.

Moraballi Creek : on upper branch of fallen tree, *c.fr.*, 287 ; 70 ft. from ground on tree in Wallaba forest, *c.fr.*, 436. Bartica-Potaro Road, 82 miles, on branch of tree in *Dicymbe* forest, *c.fr.*, with the last species, *Tutin* 269 (in part).

Distr. Guiana, *Schomburgk* 680.

Rio Negro (Brazil and Venezuela).

M. pentastichum C.M.—*M. pentagonum* C. M. Malpighia, 10, 513 (1896).

Moraballi Creek : on upper branches of dead Mora tree, *c.fr.*, 3 ; branches of Mora tree, 130 ft. from ground, *c.fr.*, 276.

Distr. Mazaruni River : near Marshall Falls, *Quelch* (ex herb. Levier No. 1279) part of type of *M. pentagonum* C.M.)

Surinam, French Guiana, Ecuador, Bolivia, Mexico, West Indies.

I am unable to find any characters separating *M. pentagonum* C.M. from *M. pentastichum*.

Schlotheimia Sprengelii Hornsch.

Moraballi Creek : on tree, 106 ft. from ground, rain-forest, *c.fr.*, 240.

Distr. Eastern Brazil, Bolivia.

RHACOPILACEAE.

Rhacopilum tomentosum (Hedw.) Brid.

Potaro River : Kaieteur Falls, shady boulders in the gorge, alt. c. 300 ft., *c.fr.*, *Tutin* 537 and 539.

Distr. Tropical and subtropical America.

FONTINALACEAE.

Hydropogonella gymnostoma (Bry. Eur.) Card. forma nov. *obtusifolia* P. W. Richards.

A typo differt foliis angustioribus plerumque obtusis.

Cuyuni River : Camaria Falls, on twigs of shrubs and small trees on rocky islets in river, with ♀ flowers, 845 (type).

Distr. Venezuela : Delta of the Orinoco, near Manaos, *c.fr.*, *Rusby and Squire* 452. The typical form has been recorded from British Guiana and Matto Grosso (Brazil).

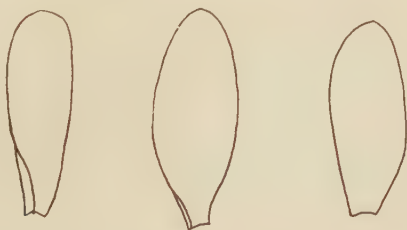


Fig. 4. *Hydropogonella gymnostoma* (Bry. Eur.) Card. forma *obtusifolia* P. W. Richards. Leaves ($\times 15$).

The narrow, not at all acuminate, leaves of this form give it an appearance somewhat different from that of the type ("Guiana Anglica", *Schomburgk*), but careful examination shows that the Cuyuni plant has a few acuminate leaves and the type a few narrow obtuse ones. The obtuse-leaved form therefore may represent only a habitat modification or even a seasonal state.

METEORACEAE.

Meteoriopsis patula (*Hedw.*) *Broth.*—*Meteorium viridissimum* C.M. Malpighia, **10, 514** (1898).

Moraballi Creek : very common on twigs of undergrowth trees, especially on Mora forest, but rarely fruiting, 106, *c.fr.*, 783. Pomeroon River, *Bartlett* 8680.

Distr. Demerara, ex herb. *Lyon*, Brit. Mus. Herb., also *Appun* 405. "Massarouni" [Mazaruni River], *Appun* 127. "Orourou Maballi or Great Falls of the Demerary", *Appun* 402. Mazaruni River : near Marshall Falls, *Quelch* (part of type of *Meteorium viridissimum* C.M.).

Tropical South and Central America, West Indies.

I can find no differences between *M. viridissimum* (C.M.) *Broth.* and normal specimens of *M. patula*.

NECKERACEAE.

Neckeropsis undulata (*Hedw.*) *Reichdt.*

Moraballi Creek : frequent on trees, but almost confined to Mora forest, *c.fr.*, 59. Cuyuni River : near Akaio Landing, on small trees in swampy secondary forest, *c.fr.*, 828.

Distr. Tropical and subtropical America.

N. disticha (*Hedw.*) *Fleisch.*

Cuyuni River : near Akaio Landing, on shrubs and stones on river bank, 848.

Distr. Tropical and subtropical America.

PILOTTRICHACEAE.

Pilotrichum scabridum *Broth.* *Hedwigia*, **45, 279** (1906).

Moraballi Creek : on upper branches of tall trees and on undergrowth trees, rain-forest, widespread, but everywhere in small quantity, 60, 128, 160 and 243. Cuyuni River : Oko Creek, on small tree in Mora forest, *Tutin* 320.

Distr. Rio Madeira (Brazil), *Ule* 2348.

The Guiana specimens agree perfectly with the part of the type gathering in Kew Herb., except that the margin of the leaves is entire instead of denticulate and plane instead of usually narrowly revolute. No. 705 (Amazon) and part of No. 703 (Santarem) of the *Musc. Amaz. et And.* also appear to belong to this species.

P. bipinnatum (*Schwaegr.*) *Brid.*

Moraballi Creek : on small trees in rain-forest, common, *c.fr.*, 57. Macouria River, *Jenman* 2334. Demerara River, *c.fr.*, *Jenman*

Herb. 7854. Cuyuni River, *c.fr.*, Bartlett 8378. Pomeroon River, *c.fr.*, Bartlett 8048. Waini River : Short Cut, Becket 8528. Berbice River : Yawakuri, Abraham 227. Cuyuni River : Akarabisi Creek, on small tree in Mora forest, *c.fr.*, Tutin 451.

Distr. Various unlocalized gatherings from British Guiana, Schomburgk and Appun in Kew Herb., Pearce in Herb. H. N. Dixon. Potaro River : Kaieteur Savannah, Jenman sine num. Roraima Range, 3500 ft., McConnell and Quelch 548. Pomeroon River : Kamwatta, Hohenkerk in Brit. Mus. Herb. Cuyuni River : vicinity of Kartabo, Graham, Bryologist, 36, 66 (1933).

Tropical South and Central America, West Indies.

HOOKERIAACEAE.

Callicostella rufescens (Mitt.) Jaeg.

Moraballi Creek : on small tree and on rotten log in forest, *c.fr.*, 259 (in part).

Distr. Surinam, Pará (Brazil), Ecuador, Trinidad.
var. nov. **demerarae** P. W. Richards.

A typo differt, *colore* viridi haud fuscescente, *foliis* brevioribus minus acuminatis, *cellulis* brevioribus apicem versus 4–6 μ latis, 8–16 μ longis, *floribus* dioicis.

Moraballi Creek : at base of large tree in Wallaba forest, *c.fr.*, 524 (type) ; with the typical form, *c.fr.*, 259 (in part) ; 430.

No. 259 agrees well with Mitten's description of *C. rufescens* and with Spruce's specimens from Pará (*Musc. Amaz. et And.* 629). The plant here described as var. *demerarae* would at first sight appear to be a distinct species, but one of the specimens of *Musc. Amaz. et And.* 629 which I have examined (that in the Cambridge University Herbarium) seems clearly to be dioicous and on some branches of the same specimen the leaves distinctly approach the var. *demerarae* in shape and areolation. The variety also shows traces of the reddish-brown colouring on leaves and branches here and there.

C. aspera (Mitt.) Jaeg.

Moraballi Creek : fallen tree trunk in forest, *c.fr.*, 218 ; on stones in forest, *c.fr.*, 769 .

Distr. Amazon, Venezuela, Ecuador, Trinidad.

Hookeriopsis Parkeriana (Hook.) Jaeg.—*Hookeria Goebellii* C.M. Flora, 83, 335 (1897). *Hookeria Roraimae* Broth. Trans. Linn. Soc. Bot. 2nd ser. 6, 92 (1901). Synonyms *fide* Brotherus, Pflanzenfam. ed. 2, 11, 243 (1925).

Moraballi Creek : frequent on small trees in all types of forest, *c.fr.*, 61, 86, 111, 348, 514. Cuyuni River, Bartlett 8158. Aruka River, Bartlett 8611. Bartica-Potaro Road : 82 miles, in *Dicymbe* forest, Tutin 259.

Distr. Guiana, Schomburgk in Kew. Herb. British Guiana, Drake

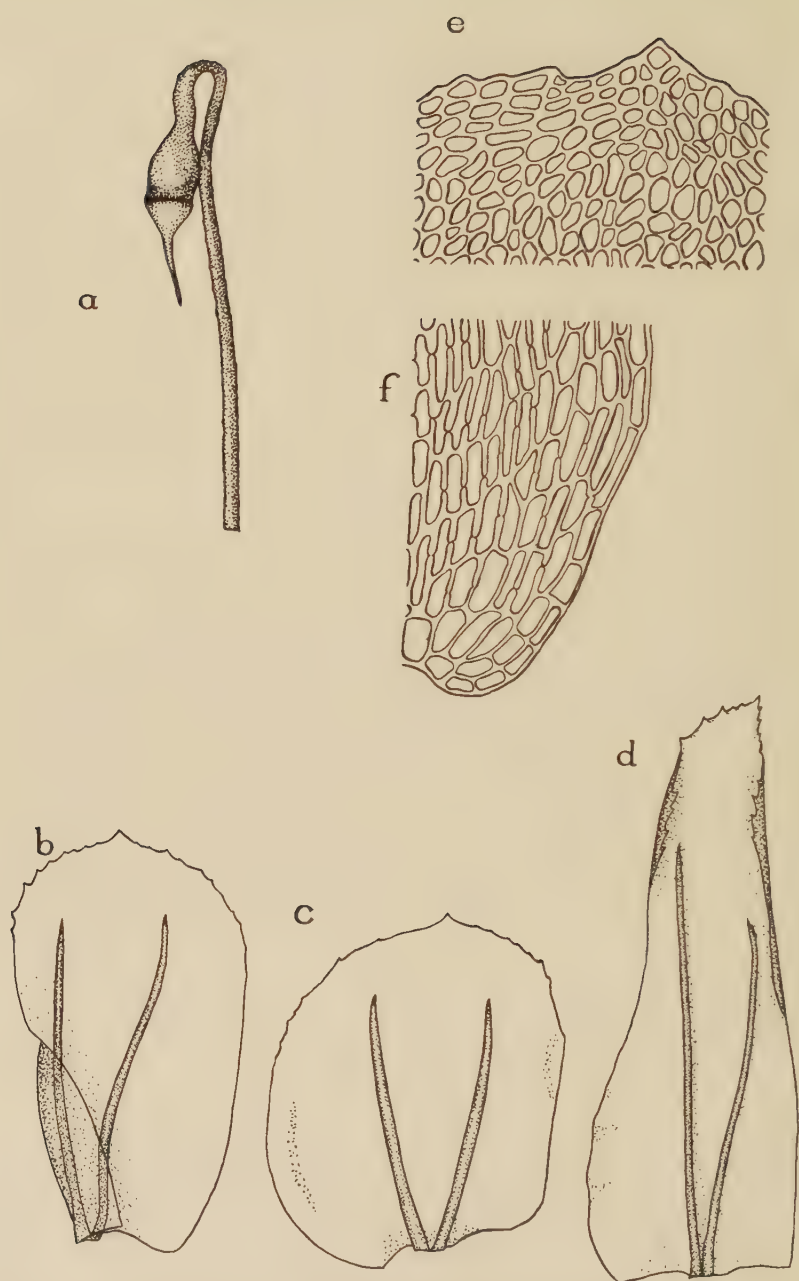


Fig. 5. *Callicostella rufescens* (Mitt.) Jaeg. var. *demerarae* P. W. Richards. a, capsule ($\times 15$); b, lateral leaf ($\times 60$); c, dorsal leaf ($\times 60$); d, perichaetial leaf ($\times 60$); e, cells at apex of leaf ($\times 250$); f, cells at base of leaf ($\times 250$).

in Kew. Herb. Asabaroo Creek, *Appun* 994. Cako Creek, *Appun* 1084. Parima River [Barima?], *Goebel*, *Flora*, **83**, 1897, p. 335 (type of *Hookeria Goebelii* C.M.). Potaro River: Kaieteur Savannah, *Jenman* sine num. in Kew Herb. Roraima Range, 3500 ft., *McConnell* and *Quelch* 490 and 550 (syntypes of *Hookeria Rorimae* Broth.).

Eastern Brazil to Barbados.

H. crispa (C.M.) *Jaeg.*

Moraballi Creek: rotten logs in forest, rather rare, 163 and 469. Both these specimens are dioicous.

Distr. Roraima, *c.fr.*, in *Thurn* 123.

Tropical South America, Costa Rica, Trinidad.

Lepidopilum subenerve *Brid.*

Moraballi Creek: frequent on undergrowth trees, especially in Mora forest, absent in Wallaba forest, *c.fr.*, 88, 104, 121, 237, 288 295, 308, 520.

Distr. Guiana, *Appun*, Mitten, *Musc. Austr. Am.* 383.

French Guiana, Venezuela, Colombia, Ecuador, Mexico, West Indies.

L. radicale *Mitt.*

Moraballi Creek: on twigs of undergrowth trees in swampy Mora forest, 495.

Distr. Rio Negro (Brazil), Colombia, Ecuador, Peru, West Indies.

L. portoricense (C.M.) *Broth.*—*L. cubense* Mitt., non *Hookeria cubensis* Sull. *Crossomitrium portoricense* C.M.

Moraballi Creek: tree trunk, 3 ft. from ground, moist forest, with female flowers and young fruit, 321; on wood submerged in small forest stream, with male flowers, 322; large form—on twigs of shrubs in swamp forest, with female flowers and one young fruit, 309.

Distr. Cuba, Porto Rico.

The type material of this species, part of which is at Kew (Aybonito, Porto Rico, *Sintenis* F 62), consists of sterile female plants only: the following particulars may therefore be added to Müller's description:—

Dioicous. Male flowers bud-like, very numerous, the bracts narrowed to fine subulate points from an ovate sheathing base. Seta 1–1.5 cm. long, pale orange, quite smooth. Calyptra with a few scattered hairs.

I have credited this species to Cuba on the strength of *Wright* 85 in the Kew and Brit. Mus. herbaria. This gathering is the type material of *Hookeria cubensis* Sull., but consists of two distinct species, viz. (i) a fertile plant with rough seta and tufts of rhizoids at the apex of the leaves, (ii) a sterile female plant with differently shaped leaves without rhizoids at their apices, but with brood-filaments in their axils. Mitten, in *Musc. Austr. Amer.* 385, described a new species *Lepidopilum phyllorhizum* based on part of *Wright* 85 and his description clearly applies to (i). Sullivan's diagnosis of *H. cubensis* (*Proc. Amer. Acad.*, **5**, 285: 1861) is so

vague that it will apply to both (i) and (ii) as far as the gametophytes are concerned, but since it includes a description of the fruit it must be held to apply to (i) only and the name *Lepidopilum phyllorhizum* Mitt. should therefore be treated as a synonym of *L. cubense* (Sull.) Mitt.

In Musc. Aust. Amer. 384, Mitten also describes a sterile plant under the name of *Lepidopilum cubense* (Sull.) Mitt., quoting Wright 85. The description is vague and very brief, but the plant meant was presumably (ii). As, for the reason just given, the name *cubense* belongs to (i), some other name must be found for (ii). I have compared (ii) with Sintenis' plant from Porto Rico and, though there are some slight differences between them, I have no doubt they are conspecific: the sterile plant in Wright 85 should therefore be called *Lepidopilum portoricense* (C.M.) Broth.

Brotherus in Pflanzenfam., 11, ed. 2, 247, observes under *L. portoricense*, "Mit dieser Art stimmt *L. cubense* Sull., Kuba, in Tracht und Blattform vollkommen überein, es ist mir jedoch am spärlichen Materiale nicht gelungen, Brutfäden zu entdecken." Evidently he must have seen a sample of Wright 85 consisting of (ii) only, on which, as is the case on some stems, the brood-filaments were not present.

My No. 309 differs rather markedly from Nos. 321 and 322 in the greater robustness, more wide-spread red colour, the leaves longer and more strongly dentate, with longer and stronger nerves and narrower cells, also in the absence of brood-filaments: it may perhaps be a distinct variety or even species, but for the present I prefer to consider it a robust form of *portoricense*.

***L. flexifolium* (C.M.) Mitt.**

Moraballi Creek: occasional on undergrowth trees, Mora and Morabukea forest only, *c.fr.*, 62, 84, 522, 601, 645. Cuyuni River: near Akaio Landing, on branches of small trees in swampy secondary forest, *c.fr.*, 826.

Distr. Guiana, Appun, Mitten, Musc. Austr. Am., 375.

Tropical South America, West Indies.

***Crossomitrium* sp.**

Moraballi Creek: on leaves of *Carludovica* sp. in swampy Mora forest, *c.fr.*, 107. Cuyuni River: Akarabisi Creek, alt. *c.* 300 ft., epiphyllous on seedlings of *Mora excelsa* Bth., *c.fr.*, Tutin 449.

Until this genus is revised, no purpose can be served by attempting to give specific identifications. No. 107 comes nearest to specimens named by Mitten *Lepidopilum Patrisiae* Brid. Tutin 449 is very like the type gathering of *C. Spruceanum* C.M.

Thamniopsis Killipii (Williams) Williams MS.—*Hookeriopsis Killipii* R. S. Williams, Bryologist, 22, 62 (1925).

Moraballi Creek: on rotting logs, frequent, *c.fr.*, 92, *det.* R. S. Williams, 284, 464.

Distr. Colombia: Cordoba, Department of El Valle, Killip 5246, Williams, *loc. cit.*

Harpophyllum aureum (*P. de Beauv.*) *Spruce*.

Demerara River, *c.fr.*, Jenman Herb. 7859.

Distr. Guiana, Ecuador, Central America, West Indies.

LEUCOMIACEAE.

Leucomium connexum *Ren. et Card.*, Bull. Soc. Bot. Belg. **41**, 113 (1902-3).

Moraballi Creek : rotten wood in Wallaba forest, *c.fr.*, 497, *det.* R. S. Williams ; on tree trunk, *c.* 3 ft. from the ground, swampy Mora forest, *c.fr.*, 110.

Distr. Porto Rico, *Heller*, *Ren. et Card.*, *loc. cit.*

L. compressum *Mitt.*

Moraballi Creek : rotten log in Morabukea forest, in deep shade, *c.fr.*, 89. Cuyuni River : Akarabisi Creek, alt. *c.* 300 ft., on rotting log, *c.fr.*, *Tutin* 452.

Distr. Amazon, Ecuador, Peru, Trinidad, Tobago.

THUIDIACEAE.

Thuidium antillarum *Besch.*

Demerara River, Jenman Herb. 7862. Potaro River : Kaieteur Fall, shady boulders in the gorge $\frac{1}{2}$ mile below the fall, *Tutin* 538.

Distr. Roraima Range, 3500 ft., *McConnell and Quelch* 549.

Brazil, Bolivia, Central America, West Indies.

PLAGIOTHECIACEAE.

Pilosium flaccisetum *C.M.*

Moraballi Creek : common on rotten logs and tree bases in forest, also on stones and sandy banks, *c.fr.*, 87, 190, 463. Demerara River, Jenman Herb. 7866. Berbice River : Yawakuri, on wet and rotting wood, *c.fr.*, *Abraham* 220.

Distr. Amakooroo [Amakura ?] River, *Goebel*, *Flora*, **83**, 339 (1897).

Bolivia.

This species does not seem to be distinguishable from *P. Cruegerianum* C.M. (a prior name), but the material of the latter which I have seen is insufficient to decide.

SEMATOPHYLLACEAE.

Rhaphidorrhynchium subsimplex (*Hedw.*) *Broth.*

Moraballi Creek : very common on tree trunks and fallen logs, especially in Wallaba forest and other well-illuminated places, *c.fr.*, 207, 271, etc., very variable in size and appearance. Berbice River : forest belts, on edges of leaves, *Abraham* 265 ; Eberoabo Creek, on decaying Wallaba trees, *Abraham* 139. Bartica-Potaro Road : 82 and 84 miles, *c.fr.*, *Tutin* 199 and 285.

According to a note attached to the two specimens of *Abraham*, this moss is called Adabara by the Arawak Indians and is used by them when burnt to ashes as a medicine for cuts and bruises.

Distr. British Guiana, *Schomburgk* 608 in Brit. Mus. Herb., *Appun* 725, 815 and 901. Mazaruni River : near Marshall Falls, *Quelch* in Kew Herb. (ex. herb. *Levier* 1269). Cuyuni River : vicinity of Kartabo, *Graham*, *Bryologist*, **36**, 67 (1933).

Tropical South and Central America, West Indies.

***Sematophyllum caespitosum* (Hedw.) Mitt.**

Moraballi Creek : submerged logs in creek, *c.fr.*, 406, 748.

Distr. Guiana, *Parker*.

Widespread in the tropical and southern subtropical zones.

***S. loxense* (Hook.) Mitt.**

Moraballi Creek : twigs of tree, 75–80 ft. from ground, *c.fr.*, 441.

Distr. Cuyuni River : vicinity of Kartabo, *Graham*, *Bryologist*, **36**, 67 (1933).

Tropical South America.

***S. subpinnatum* (Brid.) E. G. Britton.—*S. Kegelianum* (C.M.) Mitt. *Rhaphidorrhynchium flexuosum* Mitt. in sched.**

Moraballi Creek : Mixed forest, on branches of tree 81 ft. from ground, *c.fr.*, 538.

Distr. Guiana, *Parker*, Mitten, *Musc. Austr. Am.*, 486.

Tropical South America, West Indies.

The name "*Rhaphidorrhynchium flexuosum* Mitt." appears on the labels of *Musc. Amaz. et And.* 980–3 (Kew set) and in Spruce's "Catalogue," but the name is not given, nor are these specimens quoted by Mitten in *Musc. Austr. Am.* The specimens however are undoubtedly a form of *S. subpinnatum*.

***Acroporium pungens* (Hedw.) Broth.**

Cuyuni River, *c.fr.*, *Bartlett* 8086, 8090 (in part) and 8635.

Distr. British Guiana, *Appun* 404. Mazaruni River : near Marshall Falls, *Quelch* (ex. herb. *Levier* 1289).

Tropical South and Central America, West Indies.

***A. guianense* (Mitt.) Broth.**

Moraballi Creek : frequent on undergrowth trees, rarely on larger trunks, *c.fr.*, 105. Cuyuni River, *c.fr.*, *Bartlett* 8090 (in part).

Distr. Guiana, *Parker*, Mitten, *Musc. Austr. Am.*, 479.

Parā (Brazil).

***Trichosteleum papillosum* (Hornsch.) Jaeg.**

Moraballi Creek : chiefly on rotten logs, not uncommon, *c.fr.*, 195, 479, 745, 791. Pomeroon River, *Bartlett* 8049.

Distr. Surinam, Brazil.

***Potamium vulpinum* (Mont.) Mitt.**

Essequibo River : first falls, on rocks and branches of trees on river bank, 360. Cuyuni River : Camaria Falls, on branches of small trees on islets, *c.fr.*, 847 ; Akaiwang Falls, *c.fr.*, *Bartlett* 8279. Potaro River : Kaieteur Falls, *Tutin* sine num.

Distr. French Guiana, Rio Negro (Brazil), Orinoco Basin.

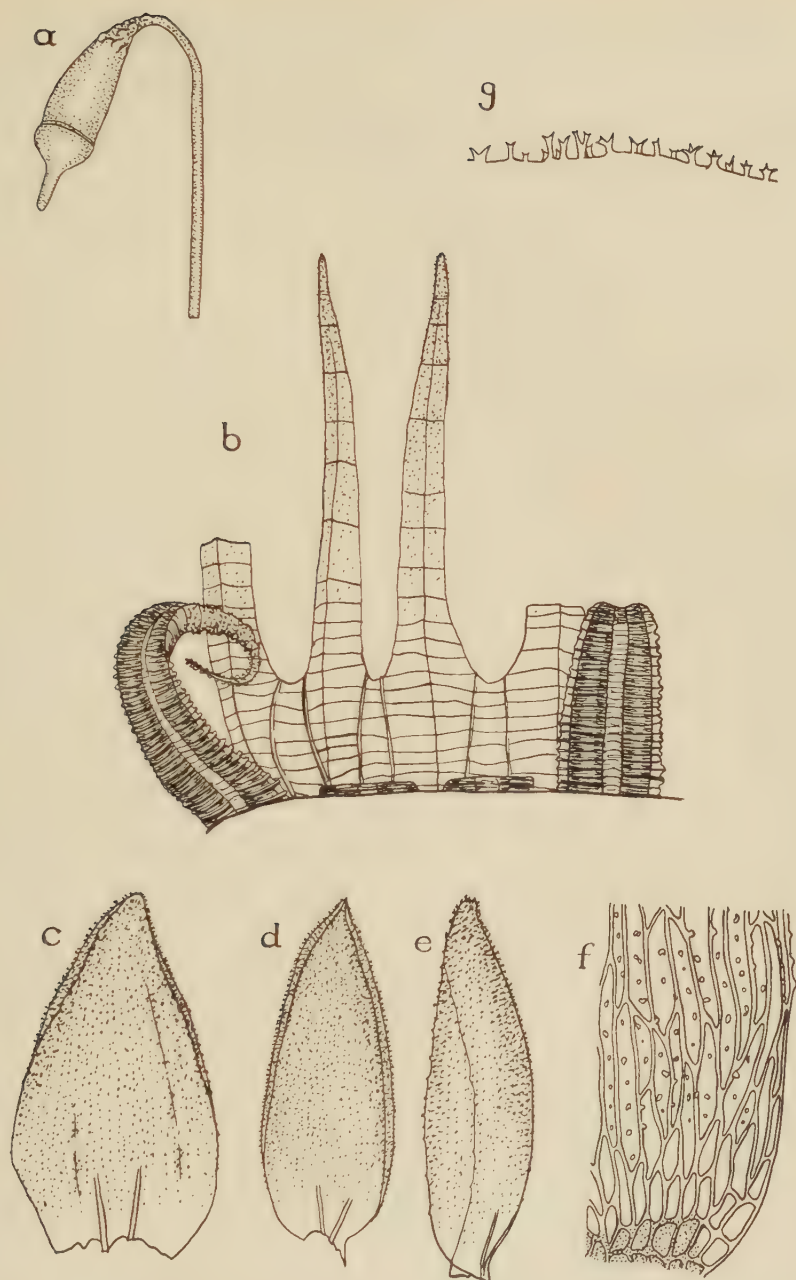


Fig. 6. *Pseudohypnella guianensis* P. W. Richards. a, capsule ($\times 15$); b, part of peristome ($\times 250$); c, stem leaf ($\times 60$); d, branch leaf ($\times 60$); e, branch leaf in side view ($\times 60$); f, cells at angle of leaf ($\times 250$); g, papillae near apex of leaf in profile ($\times 250$).

Taxithelium planum (Brid.) Mitt.

Moraballi Creek : very common, *c.fr.*, 371, 425, 482, 501. Cuyuni River : Kartabo Point, sandy beach and trunks of trees on river bank, *c.fr.*, 835 ; Camaria Falls, on small trees in river, *c.fr.*, 850. Demerara River, Jenman Herb. 7856. Bartica-Potaro Road : 82 miles, in *Dicymbe* forest, *c.fr.*, Tutin 257.

Distr. Unlocalized gatherings from British Guiana, *Parker, Drake, Appun* 665 and 810, in Kew. Herb. Mazaruni River : earn Marshall Falls, *Quelch* in Kew Herb. (ex. herb. *Levier* 1270) : Penal Settlement, *Graham*, Bryol. **36**, 67 (1933). Cuyuni River ; Matope Falls and vicinity of Kartabo, *Graham, loc. cit.*

Tropical South and Central America, West Indies.

Nos. 835 and 850 are a large aquatic form differing widely from the forest form in general habit, in the less complanate branches, more obtuse leaves, etc. *Musc. Amaz. et And.* 953 (labelled *Taxithelium concavum* Hook. in Kew Herb.) is a similar aquatic form.

Pseudohypnella guianensis *P. W. Richards*, sp. nov. Theca minore, haud turgida, peristomio ciliis nullis, operculo rostro subulato instructo, seta brevior, a *P. verrucosa* (Doz. et Molck.) Fleisch. facile distinguenda, praeter fructum satis similis.

Planta statura quam *P. verrucosa* paulum minor : caespites lati, depressi, madore laete pallide virides, siccitate albescentes, nunquam nitidi. Caulis ruber, repens, irregulariter pinnatim ramosus, 2–3 cm. longus, ramis ad 0.5 cm. longis plerumque simplicibus. Folia quam in *P. verrucosa* angustiora, undique laxe imbricata, caulina late ovata basin versus paulum contracta, 0.6–0.8 mm. longa, 0.3–0.4 mm. lata, nonnunquam parum plicata, valde concava, apice subcucullata, acutiuscula vel obtusa, plerumque recurvata, margine inferne integerrima superne papillis prominentibus denticulata, costis indistinctis vix $\frac{1}{3}$ folii attinentibus, ramea 0.65–0.85 mm. longa, 0.3–0.4 mm. lata, magis uniformia, apice semper recurvata ; cellulae foliorum angustissimae, subtiliter curvatae, 4–5 μ latae, 60–80 μ longae, basin versus laxiores, basilares ad 10 μ latae, omnes utrinque praeter foliorum basin papillis numerosis praeditae ; papillae ad 12 μ longae, saepissime bifidae vel trifidae.

Autoica. Bractae florum masculorum internae ovato-acuminatae, acutae, laeves vel superne papillosae, externae foliis caulinis similes. Folia perichaetialia acuminata, superne papillis longissimis numerosissimis oblecta, ceterum foliis rameis similia.

Seta 1–1.5 cm. longa, laevis, rubella. Theca circiter 0.7 mm. longa, 0.5 mm. lata, angusta, haud turgida, latitudinem maximam ore attingens, ad collum sensim attenuata : collum et saepe etiam seta superne grosse mammosum : operculum hemisphaericum, rostro subulato circiter 0.3 mm. longo : peristomii dentes externi fulvi, minute striati, lamellis multis confertis, superne papilloso, externe longitudinaliter sulcati, interni flavi vel hyalini ; cilia nulla. Sporae virides, laeves, 7–10 μ diam.

Moraballi Creek : on log in Wallaba forest, *c.fr.*, 407 (type).
Berbice River : Yawakuri, on decaying tree trunks, *c.fr.*, *Abraham*
221.

The only species of the genus known hitherto is found in the Eastern Tropics. Mr. H. N. Dixon has kindly sent me the following note on the new species : " The geographical distribution is very remarkable, but the gap is to some extent bridged if *Taxithelium truncatum* Broth. (*Homalia truncata* Welw. & Duby) from Angola is included in the genus, as it seems to me to have a good title to be ; as the sporophyte is much more like yours, with rostrate lid. The only real difference is that the large bifid papillae are hardly shown, though the marginal papillae are sometimes bifid.

" On the other hand if this species is transferred to *Pseudohypnella* there is the question of the other species of *Taxithelium* § *Limnobiella* (or *Collophyllum*) which are near *truncatum* but much further from *P. verrucosa*."

In any case, Fleischer's reasons for placing *Pseudohypnella* in the *Hookeriaceae* are insufficient : its nearest allies would seem undoubtedly to be the genus *Taxithelium* in the *Sematophyllaceae*.

HYPNACEAE.

Ectropothecium apiculatum (*Hornsch.*) Mitt.

Moraballi Creek : on rotten log in Mora forest, *c.fr.*, 646.

Distr. Tropical South and Central America, West Indies.

Vesicularia vesicularis (*Schwaegr.*) Broth. var. **amphibola** (*Spruce*)
R. S. Williams, comb. nov.—*Ectropothecium amphibolum* Spruce ex Mitt.

Cuyuni River : near Akaio Landing, in bed of small dried-up stream in forest, 823.

Distr. Tropical South America, West Indies.

Rhacopilopsis trinitense (*C.M.*) *E. G. Britton et Dixon*.—*R. Pechuelii* (*C.M.*) Card.

Moraballi Creek : Mora and Morabukea forest, not common, 241, 377, 692.

Distr. British Guiana, *Appun* sine num.

French Guiana, Trinidad, Tropical Africa, Madagascar.

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XLII—MISCELLANEOUS NOTES.

GEORGE THORNCROFT.—We record with regret the death of Mr. George Thornecroft at Barberton, Transvaal, on July 19th, 1934, in his 77th year.

Mr. Thornecroft developed his early love of flowers after settling in South Africa, about the year 1881, and it was mainly during his residence at Barberton, from 1886 to 1892 and then from 1902 until his death, that he devoted himself so successfully to the study of the local flora.

He was greatly encouraged in his botanical work by the late Dr. J. Medley Wood of Durban, to whom he sent the bulk of his collections. He was a self-taught botanist and acquired a wide knowledge of species, and he was quick to recognise a new plant. One of his most interesting discoveries was a Labiate, which proved to be a new genus, and was named *Thornecroftia* in his honour by Dr. N. E. Brown (Bot. Mag. t. 8824). This he found in the mountains near Barberton in April, 1911, and from plants grown at the Cambridge Botanic Garden by Mr. Irwin Lynch, with whom he corresponded frequently, the Botanical Magazine figure was prepared.

He was particularly interested in succulents, and sent home many living plants of *Ceropegias*, *Euphorbias*, etc., both to the late Mr. Walter Ledger and also to Kew and to Cambridge.

In 1931, not long after meeting me at Durban, he collected seed of *Streptocarpus Dunnii*, at my request, and sent it to Kew, thus re-introducing this interesting species which had been lost to cultivation for many years since its original introduction by Mr. E. J. Dunn.

His collection amounted to some 4000 specimens which he sent to the principal South African herbaria; many were also received at Kew either direct from him or through the kindness of Dr. Medley Wood. In addition to the new genus, his name is perpetuated in the specific names of several of the new plants he discovered.

A. W. H.

ETHELBERT BLATTER.—It is with much regret that we record the death, at the early age of 57, of Father Ethelbert Blatter, S.J., at Poona on the 26th May, 1934. He had been ill for some years and was living at Panchgani, where he had been Parish Priest since 1925. His end was hastened by a riding accident in 1930 while on a botanical exploration in Waziristan.

Father Blatter was born in 1877 in the Swiss Canton of Appenzell and was educated at various schools in Switzerland. Later he pursued his studies at Jesuit Institutions in Austria, Holland and England. He first went to India in 1903 as Professor of Biology at St. Xavier's College in Bombay, of which college he became Principal in later years. He devoted himself mainly to botany, though he could have achieved distinction equally well in zoology or geology.

A very large amount of valuable botanical work came from his pen, which has been published chiefly in the pages of the "Journal of the Bombay Natural History Society," of which society he was a Vice-President, in the "Journal of Indian Botany," and in the "Records of the Botanical Survey of India." He worked for some time in the Kew Herbarium, principally on the flora of Aden and of Arabia, and had intended returning to continue his study of the latter but was prevented by illness. It is understood that his last work was the completion of his "Flora Arabica," the final part being now in the press.

A man of very genial disposition, his loss is mourned by a large number of devoted friends in all circles of society in India and elsewhere, and leaves a gap in the rank of botanists interested in the Indian flora that will be hard to fill.

C. E. C. FISCHER

S. K. MUKERJI. We have to record with regret the sudden death, following an operation for appendicitis, of Dr. S. K. Mukerji, M.Sc., D.Sc., F.L.S., Reader in Botany, University of Lucknow. Dr. Mukerji, though still a young man, had already carried out a considerable amount of valuable work in taxonomy, ecology and the exploitation of Indian medicinal plants. While working on the ecology of *Mercurialis perennis* he studied for a period in the Kew Herbarium. His early death will be a great loss to botanical science in India.

The Families of Flowering Plants : Volume II, Monocotyledons.*—Mr. Hutchinson's second volume dealing with the Monocotyledons has now been published. The families are arranged according to his new system based on their probable phylogeny, continuing the arrangement which he has worked out for the Dicotyledons. The volume is prefaced by the following foreword by the Director :—

We have been awaiting with keen anticipation the completion of Mr. Hutchinson's work on the Families of Flowering Plants and are now able to offer him our congratulations on the appearance of his treatise on the Monocotyledons. The lapse of eight years since the "Dicotyledons" appeared has on the whole been of advantage, since it has allowed botanists time to study and digest the earlier volume and to realise that not only do they appreciate the value of his researches, but that they are also generally in agreement with his conclusions.

This encouragement has naturally stimulated Mr. Hutchinson in the pursuit of his work on the Monocotyledons, in many ways a far more puzzling and involved division of the vegetable

* By J. Hutchinson, F.L.S. Macmillan & Co., Ltd., St. Martin's Street, London, W.C.2. Pp. xiii + 243, figs. 107 and maps. Price 20s. net.

kindom, and despite the many other calls upon his time he has been able to concentrate his attention on the numerous problems which a study of the Monocotyledons discloses. Perhaps the most spectacular result of his research is his treatment of the great agglomeration of genera, which up to the present have been assigned either to the *Liliaceae* or to the *Amaryllidaceae*. Mr. Hutchinson has boldly thrown aside the position of the ovary as the dominating character for separating these two families and, after careful consideration of all the evidence, he has been led to the view that much more weight should be attached to the type of inflorescence. He therefore places in the *Amaryllidaceae* all those genera which have an umbellate type of inflorescence, whether one- or many-flowered, accompanied by spathaceous bracts, a feature not met with in the true lilies. Thus *Agapanthus* and the Onions (*Allieae*), for example, despite their superior ovary, find themselves linked with the Crinums and Daffodils. Whether all botanists will agree as to the Onions or not, it is certainly usually somewhat of a shock to the "man in the street" that they may be allied either to Lilies or Daffodils!

Though the treatment of these two families may arouse some controversy among the more conservative taxonomic botanists, it is, I believe, generally felt that the present *Liliaceae* is not a very natural family. This revision of the two families, therefore, is all the more welcome.

It is pleasant to find that *Aspidistra*, beloved of Bayswater landladies, has at last received the scientific distinction which apparently it deserves. For it bears on its shoulders the *Arum* family, which is considered to be the culmination of the phylogenetic line *Liliales-Aspidistreae-Arales* :

Per Aspidistra ad Astra !

As in the previous volume, there is a very useful key to the families, but in this one Mr. Hutchinson has performed a signal service by drawing up keys to the genera of most of the families, thus adding greatly to the value of the work and making it a "Genera Plantarum" in miniature for the Monocotyledons.

Another new departure, which has important phylogenetic bearings, is the separation of the petaloid Monocotyledons into two groups, one designated *Calyciferae*, with a separate calyx and corolla, emphasising the close relation of this group to the Ranalean Dicotyledons; a fact also indicated by the numerous examples of apocarpous ovaries met with in the group.

Mr. Hutchinson is fortunate in having had the assistance of Mr. J. E. Dandy in connection with the *Hydrocharitaceae*, and of Mr. V. S. Summerhayes and Mr. C. E. Hubbard with the Orchids and Grasses respectively. The account of the *Gramineae* is particularly useful, since it is accompanied by drawings, prepared by Mr. Hubbard, of the floral details of all the tribes.

As in the previous volume, much has been pulled down, but the old materials have been rebuilt into a new edifice in harmony

with the spirit and design of the great work of Bentham and Hooker.

In commending this interesting volume to the careful consideration of my botanical colleagues, may I do so again in the words of Horace, "*Disce docendus adhuc, quae censet amicus.*"

ARTHUR W. HILL

ROYAL BOTANIC GARDENS, KEW

April 1934

It is gratifying to learn from the above spirited foreword that botanists have not only appreciated but are now in general agreement with Mr. Hutchinson's views on the classification of Dicotyledons as expressed in his first volume of "The Families of Flowering Plants" published eight years ago. He then took the line that the most primitive flowers are *hermaphrodite*, possessing the full complement of parts with the members of each category (perianth segment, stamen and carpel) not definitely fixed in number, spirally arranged on a conical receptacle and free from one another. Consequently such families as the *Magnoliaceae* and *Ranunculaceae* appear at the base of his phylogenetic tree. This is in direct opposition to Engler and Prantl's system which commences the Dicotyledons with *unisexual* flowers of few parts, such as are to be found in the catkin-bearing trees (the *Amentiferae*). The Englerians have regarded these flowers as *primitively simple* and may, in some quarters, still do so. Hutchinson and his school, on the contrary, look upon them as *simplified* through extreme reduction.

Engler similarly begins the Monocotyledons with flowers of this type, such as occur in the reedmace (*Typha*) and the screw pine (*Pandanus*). Hutchinson naturally regards these also as greatly reduced and so advanced from the evolutionary standpoint. As a basis for his phylogenetic classification he looks instead for hermaphrodite flowers with as little modification and definiteness in their parts as possible. He finds these in the *Butomaceae* and the *Alismataceae*, and considers the resemblance their flowers bear to those of the Ranalian families to be a sign of real affinity and not merely one of parallel development. For instance, except for the presence of only a single cotyledon and the absence of endosperm in the ripe seed, the flower of *Butomus* differs little in structure from that of *Cabomba*, and the flower of *Ranalisma* from that of *Ranunculus*. Consequently Hutchinson seeks for the origin of the Monocotyledons in what has been called the Ranalian plexus.

It is now, I think, generally agreed that the Monocotyledons had Dicotyledonous ancestors, and it has even been suggested that they have had a two-fold origin from these. An attempt has been made to derive the Arum family (*Araceae*) from the peppers (*Piperaceae*). Hutchinson examines this idea only to reject it, favouring a monophyletic origin for the whole group. He sees in *Aspidistra*, as Sir Arthur humorously points out, the source of the *Araceae*.

It is unnecessary to draw attention to the main original features of this new arrangement of the Monocotyledons, as these are commented upon in the above foreword. From a glance at the attempted scheme to link together all the orders into one phylogenetic tree (p. 7), the position assigned to the *Zingiberales* (*Scitamineae*) is perhaps the least convincing. Though we are prepared to see no close relationship between this order and the orchids—merely in fact a certain parallelism—its *direct* derivation from such a specialised group as the Bromeliads seems a little forced. No mention is made of the presence of perisperm in the ripe seed of the *Zingiberales*; but perhaps the author uses the term endosperm in a wide sense to cover all storage tissue in the seed external to the embryo itself.

Not only is the volume before us replete with information and suggestiveness, but owing to its numerous illustrations it may be deemed a work of art, and not least so in the floral design which embraces the graceful dedication to Agnes Arber of Cambridge. As in the previous volume dedicated to the memory of Bentham and Hooker, Mr. Hutchinson deftly weaves into the design his phylogenetic views, placing the primitive flowers at the base and then gradually leading up to the most advanced at the top with the orchid as representing the most evolved insect-visited flower and the grass as the most specialized for wind-pollination.

By the completion of "The Families of Flowering Plants" Mr. Hutchinson has opened a new chapter in systematic botany. Though old systems die hard, and it may be some time before his permeates the botanical world generally, yet English botanists should welcome it gladly. We have never taken kindly to the system of Engler and Prantl. That of Bentham and Hooker founded on the system of De Candolle is long out of date. It is really pre-Darwinian and so not phylogenetic; though as it happens Hutchinson's new system is less a break-away, at any rate as regards the Dicotyledons, from that of Bentham and Hooker than from that of Engler and Prantl; and it is fitting that it should be so.

J. PARKIN.

Michel Adanson.*—Professor Chevalier has performed a signal service in writing a short history of the life and work of Michel Adanson (1727–1806), traveller, naturalist and philosopher, whose name is remembered in the latin name of the baobab tree (*Adansonia*), which Linnaeus named in his honour. When he was only thirteen he compiled a catalogue of the plants (more than 5000), cultivated in the Royal Garden at Paris. He studied works of natural history with avidity during the following years, and in 1748, when he was only 21, he was selected to go out to Senegal as Naturalist, to make an inventory of the natural resources of the colony. He sailed from France on this enterprise on March 3rd,

* Michel Adanson: *Voyageur, Naturaliste et Philosophe*, by Prof. Aug. Chevalier. Larose, Éditeurs, 11, rue Victor-Cousin, Paris. Pp. 172. Price not stated.

1749, and reached Senegal on April 25th. For the next four years and four months he remained in Senegal and investigated with the greatest assiduity the vegetation, the animals, the geology and geography of the region. During his stay he made large collections of both living and dried plants which he eventually brought home and then commenced his monumental work on the Natural History of Senegal. On his return to Paris, Louis XV gave him the title of "Botaniste Royal" and granted him leave to reside at Trianon, where he carried on his studies.

His narrative "A Voyage to Senegal, the Isle of Goree and the River Gambia," which was accepted by the Academy of Sciences in 1756, and translated into English and published in London in 1759, gives a most interesting account of his activities in Senegal and is well worthy of study. Adanson was a most exact and careful investigator, and carried out his travels and made his observations in the face of difficulties unknown to travellers of the present day.

At the age of 26 he was corresponding with Linnaeus, and in 1756 he presented to the Academy his Memoir on the baobab.

In 1757 he published the first volume of his "Natural History of Senegal" and as a result, at the age of 30, he was elected a member of the Academy of Sciences and also of the Royal Society of London.

Other important works which Adanson produced were his "Ordines naturales" (1753) and "Familles des Plantes" (1763). His large collections of Senegal plants, seeds, animals, minerals, etc., to the number of 5211 objects were handed over to the Cabinet of the Royal Garden in 1765, accompanied by a catalogue. For this gift he received a pension from the King.

His main occupation from 1765 to 1772 was to find a publisher for his "Natural History of Senegal," as the editor of the first volume had become bankrupt, but none could be found. Another piece of work, his "Histoire de la Botanique" to which he devoted much labour, was published from his MS. by Alexandre Adanson and J. Payer. This, though printed in 1847, did not appear until 1864.

With the death of Louis XV in 1774 his hopes of assistance vanished and he also had to leave Trianon. He had expected to succeed Buffon at the Royal Garden, but here again his hopes were frustrated, though the post had virtually been promised to him. During the rest of his life he lived in Paris making a few travels in search of plants and other natural history objects. He was occupied all this time in collecting information in every branch of natural history, with the object of compiling a vast "Encyclopaedia of Natural Science"—a work of huge proportions which has never been published. To this work he devoted all the remaining years of his life, becoming almost a hermit and seeing hardly anyone. Working unceasingly, he read and annotated every book bearing on the subject and amassed an extraordinary amount of material. He died a lonely and disappointed man, but his work on the flora, fauna and geography of Senegal is an enduring memorial which still compels our admiration.

Dr. J. Hutchinson.—We record with pleasure the conferment of the Honorary Degree of Doctor of Laws on Mr. John Hutchinson, Botanist in the Herbarium, by the University of St. Andrews on Tuesday, October 16th. The ceremony, at which the Director was present, took place on the occasion of the installation of the Right Hon. J. C. Smuts as Rector of the University. In presenting Mr. Hutchinson to the Chancellor of the University—Mr. Stanley Baldwin—the Dean of the Faculty of Arts gave the following oration :—

“ Mr. Hutchinson, whose career is itself a tribute to the system of promotion that prevails at Kew, is a botanist whose detailed work on the Families of Flowering Plants marks the end of an old, and the opening of a new chapter in British systematic botany. Four years after he entered Kew Herbarium he became assistant for Tropical Africa, and his devotion to African botany was pledged. Twice at the invitation of the Government he visited and explored the country, and on these journeys had with him as fellow traveller and collector a South African systematic botanist of no mean order—the Rector of St. Andrews. On the mountains at the southern end of Tanganyika they were fortunate to find a new species* of a genus known formerly only farther south ; and one of them gave to it the other's name. We congratulate them both to-day on adding simultaneously to their vasculums a northern specimen, which, if not exactly rare, for it is something of a hardy annual now, is still coveted by many, and not easy yet to come by—the *Doctoratus Andreensis utriusque legis*.”

General Smuts was similarly honoured with the Hon. LL.D. before he was installed as Rector.

* *Pteronia Smutsii*. Hutch.